Con-X Spectra of Radio-Quiet, High-Redshift Quasars

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- **New results from Chandra: Evolution with redshift**
- **Adding background to simulations**
- **Science with HXT**

Introduction

- X-rays arise in Comptonized wind or corona associated with the accretion disk
- General picture well supported, but details like geometry of scattering material unknown; beginning to be explored through X-ray + UV spectral fitting
- Chandra & XMM have allowed detection of many quasars, and determinations of power law slopes in 1-10 keV (observed), or 5-50 keV (rest) at z=4.
- However, most z=4 quasars are faint, and impossible to collect enough photons with Chandra or XMM-Newton (most have 100-200 photons total) for determining much more than X-ray flux and crude spectral index; too faint for Astro-E HXT
- Stick to Radio Quiet majority --> see accretion disk emission without complicating X-rays from radio plasma, beaming

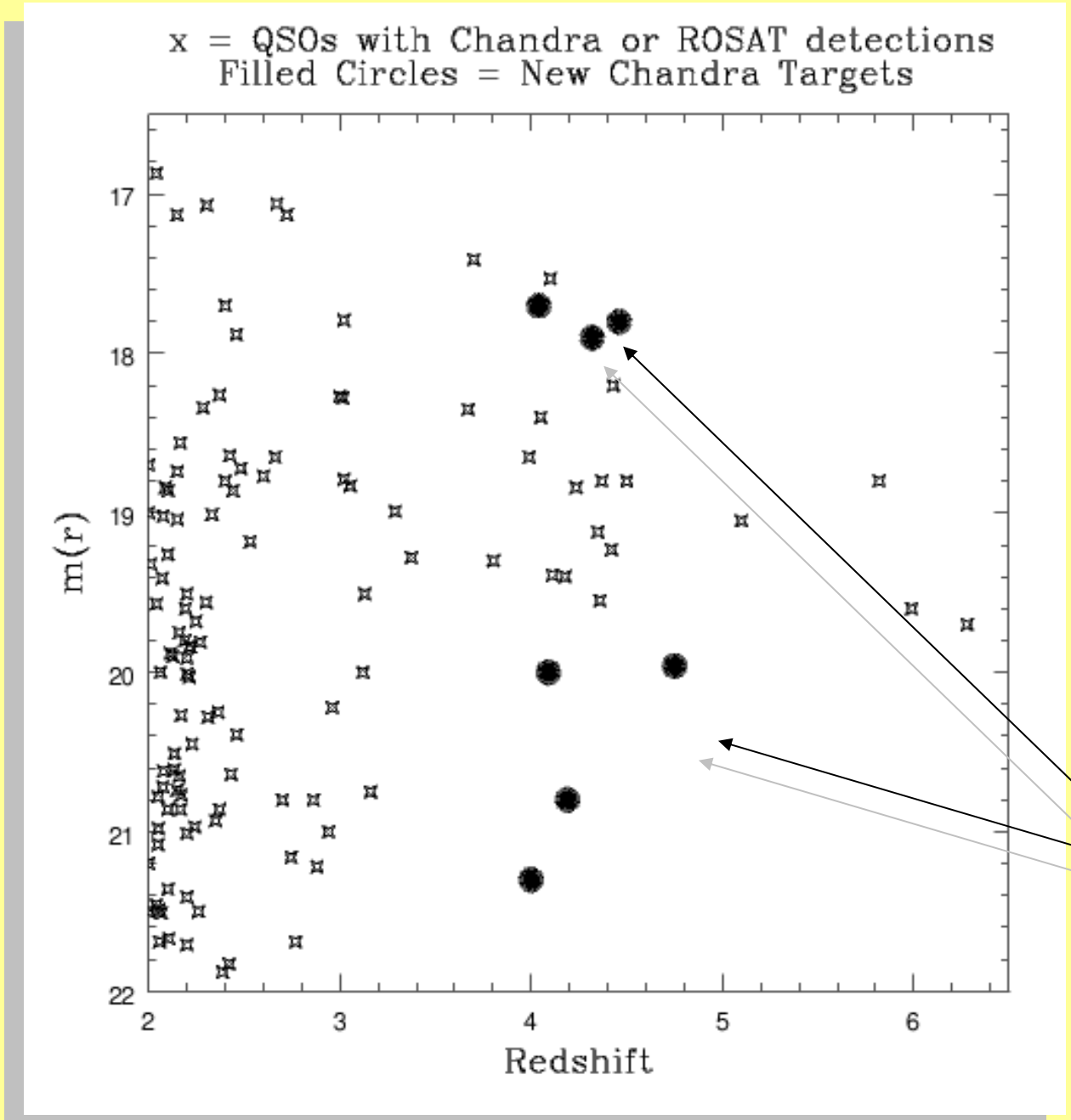
--> M(BH), accretion rate as function of redshift

Evolution of alpha_ox

Kelly, Bechtold, Siemiginowska, Aldcroft, Elvis & Sobolewska 2006, ApJL, in press

- Previously available samples had strong correlations between L and z
- Difficult to say if X-ray properties depend on one or the other; conflicting claims in literature
- New Chandra Observtaions of optically faint, z>4 quasars
- Result: alpha_ox depends significantly on both L and z

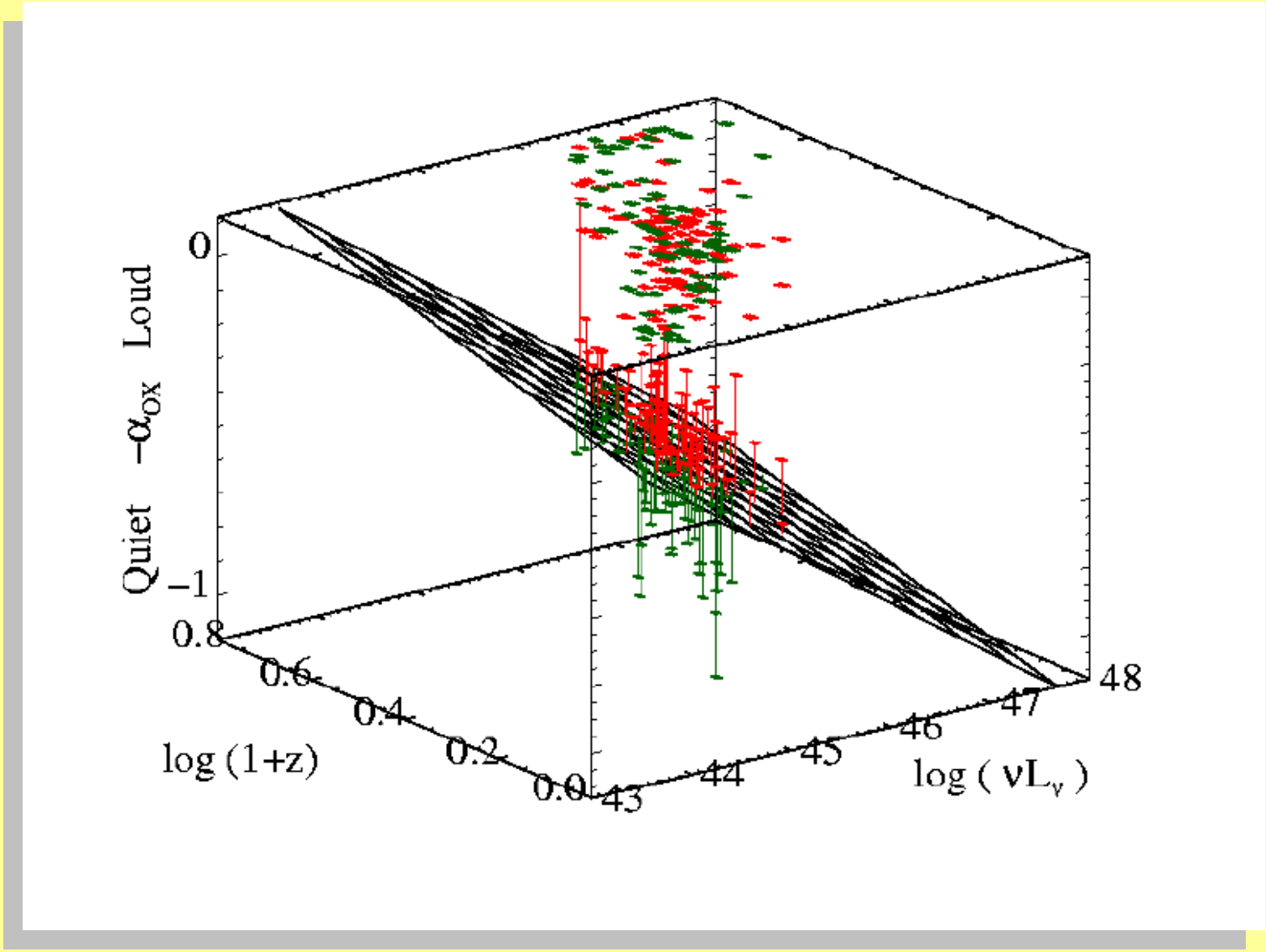
Sample: Optically faint, radio-quiet quasars with z>4



Radio-quiet quasars:

X-ray quieter as UV luminosity increases (6.8 sigma)

X-ray louder as redshift increases (3.2 sigma)



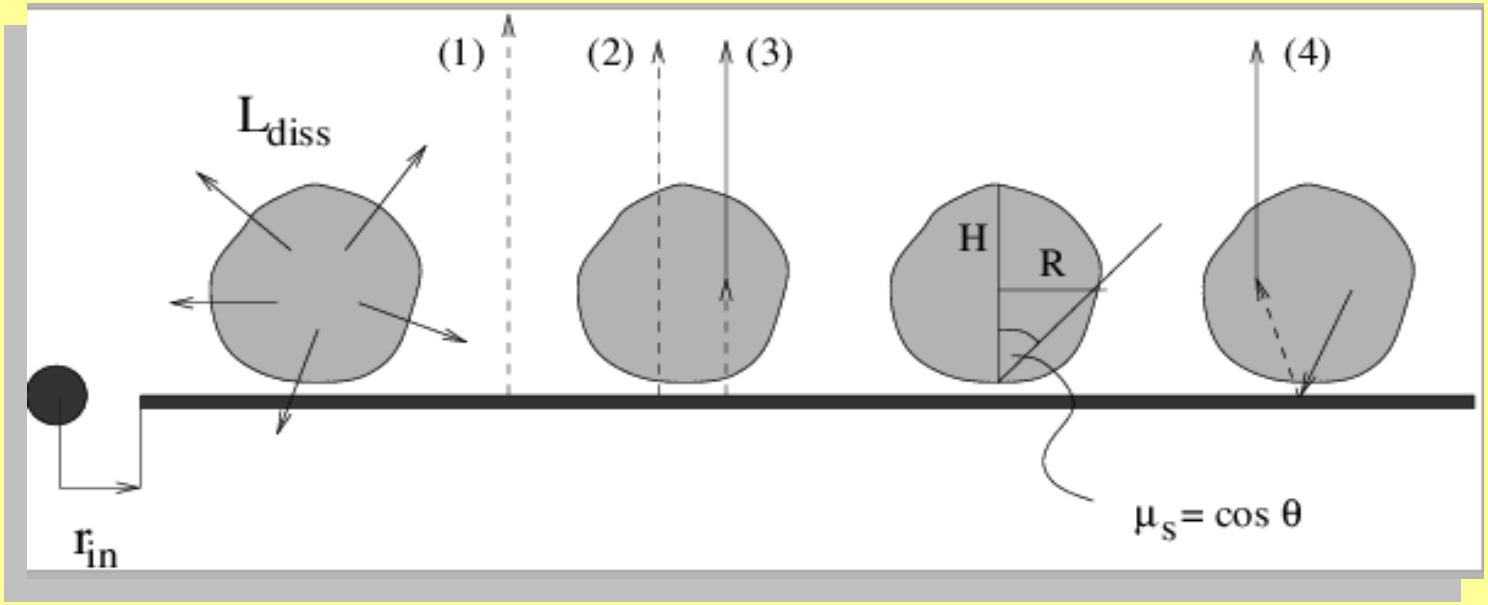
Models reproduce alpha_ox to be function of M(BH), accretion rate, corona properties

Sobolewska et al. (2004ab)

1. L(UV) inc. when disk extends further towards last stable orbit, X-ray cont. softens

2. Patchy corona: change energy dissipation in corona

3. more flares at high z



Need for HXT spectra *Sobolewska et al. 2004*

Fraction of energy disipated in corona

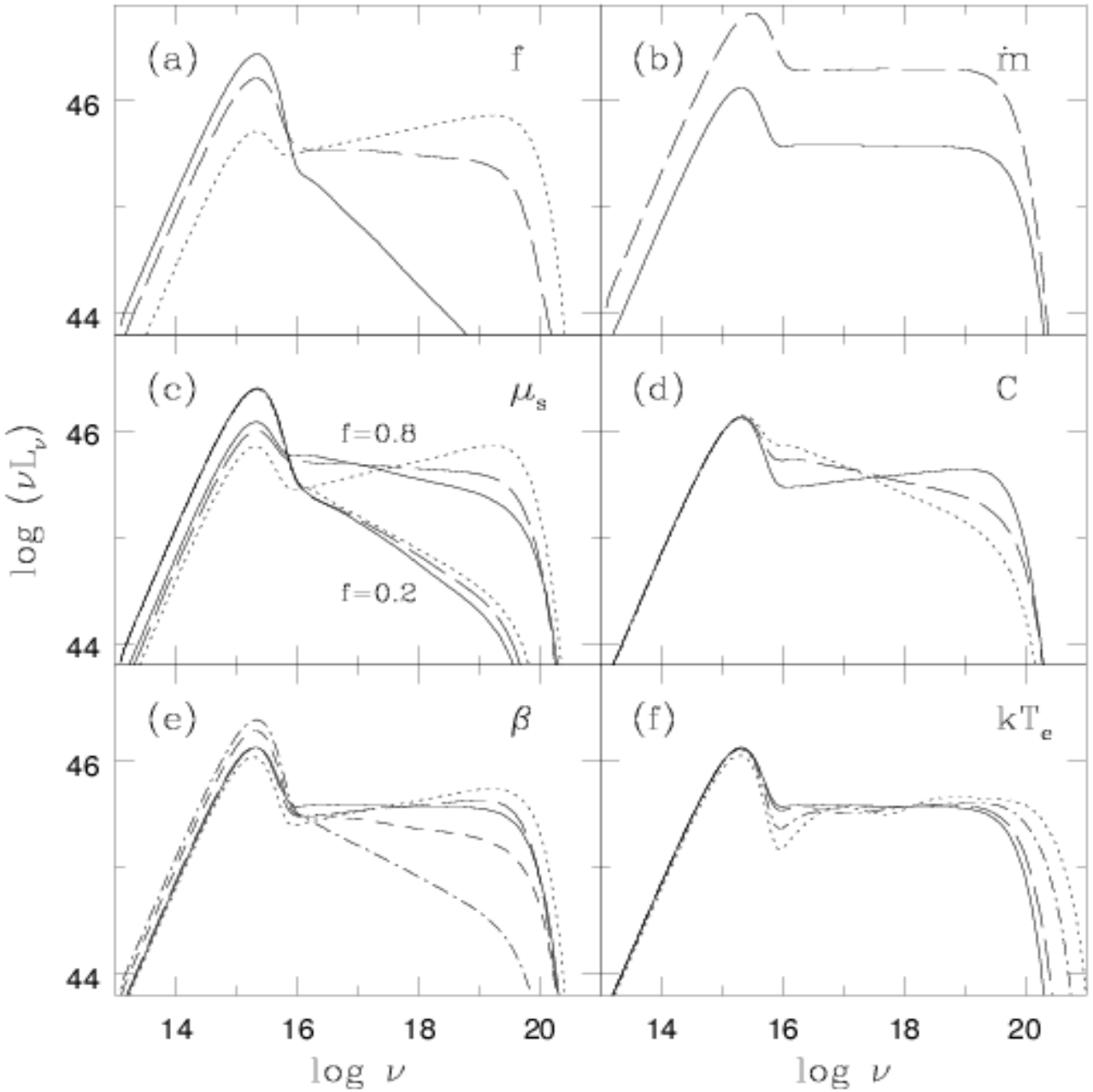
Accretion rate

Aspect ratio of clouds for patchy model

Covering factor of clouds

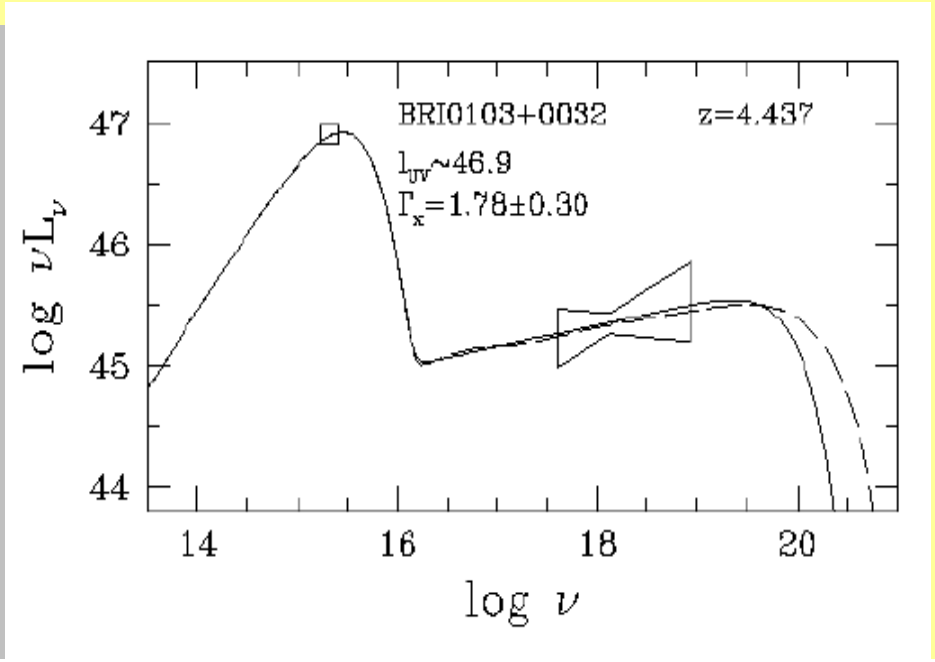
Vertical velocity of clouds

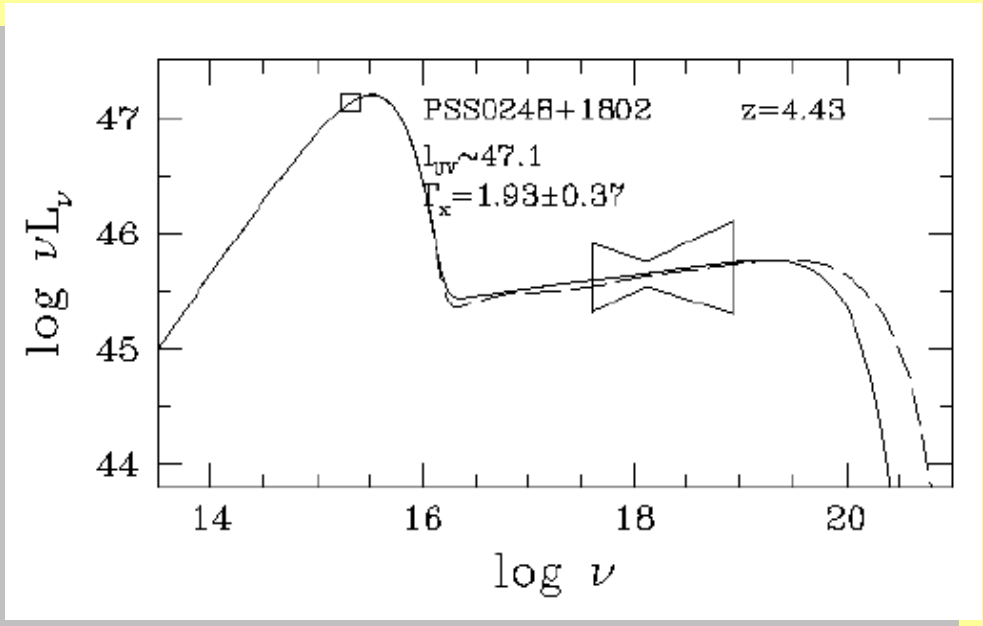
Temperature of scattering electrons

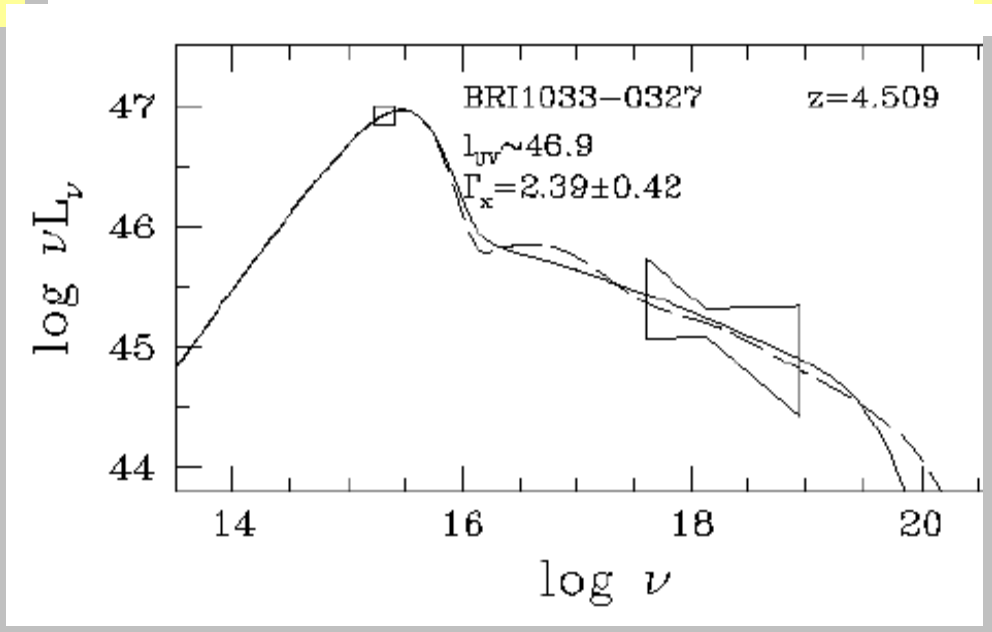


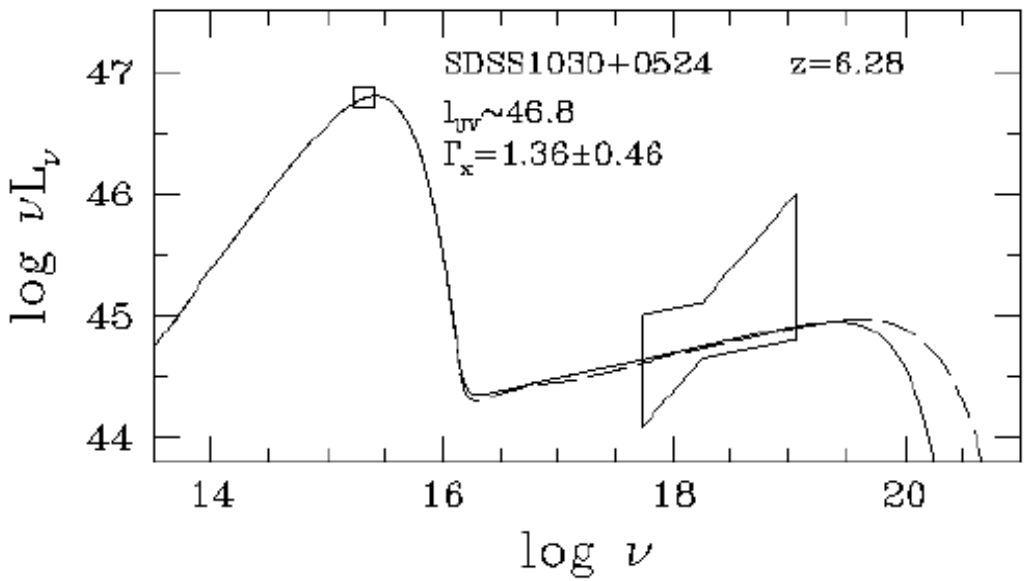
Need HXT spectra: slope and high energy cut-off

Sobolewska et al. 2004 SED fits with Chandra spectra







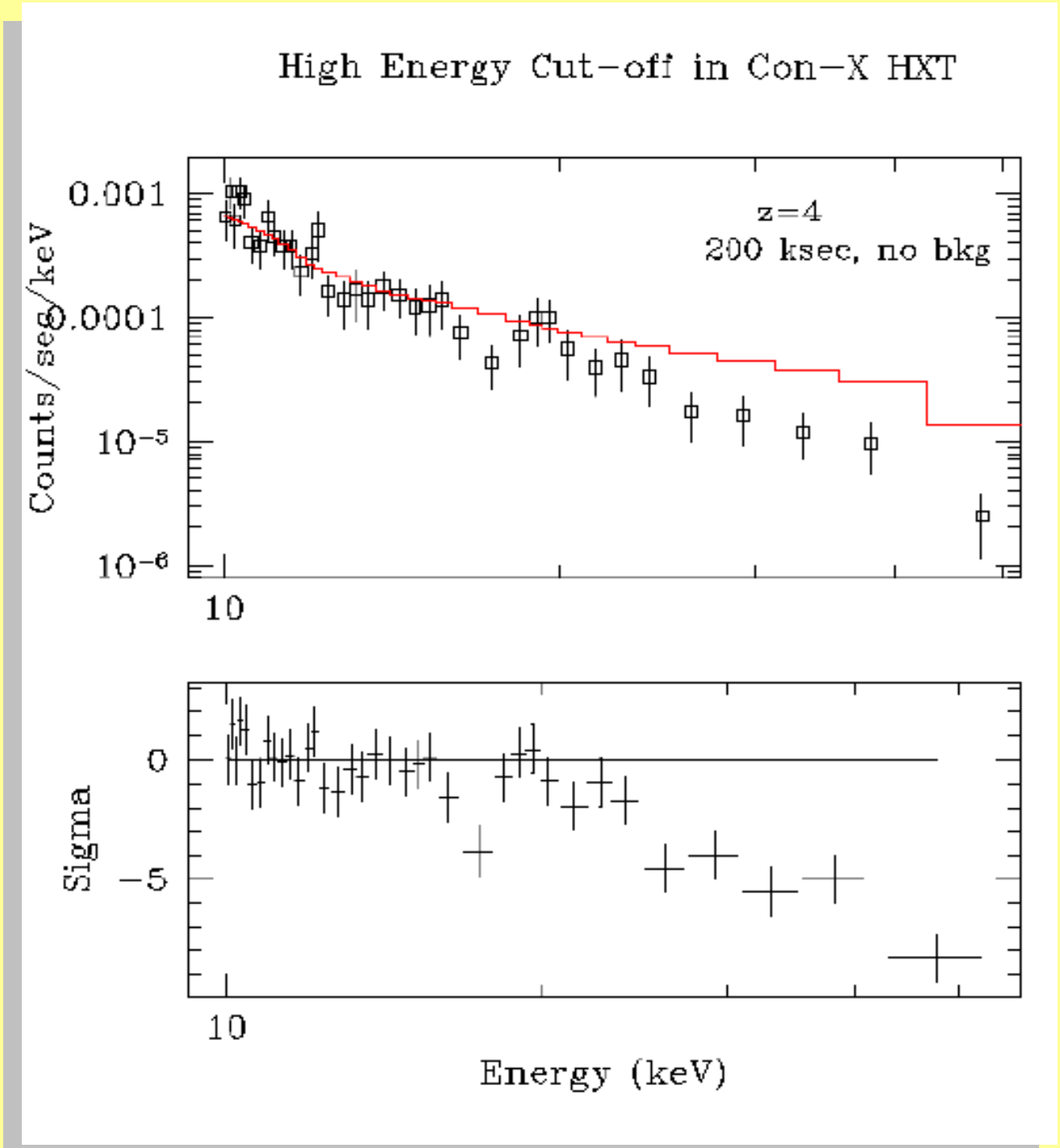


Con-X HXT simulation

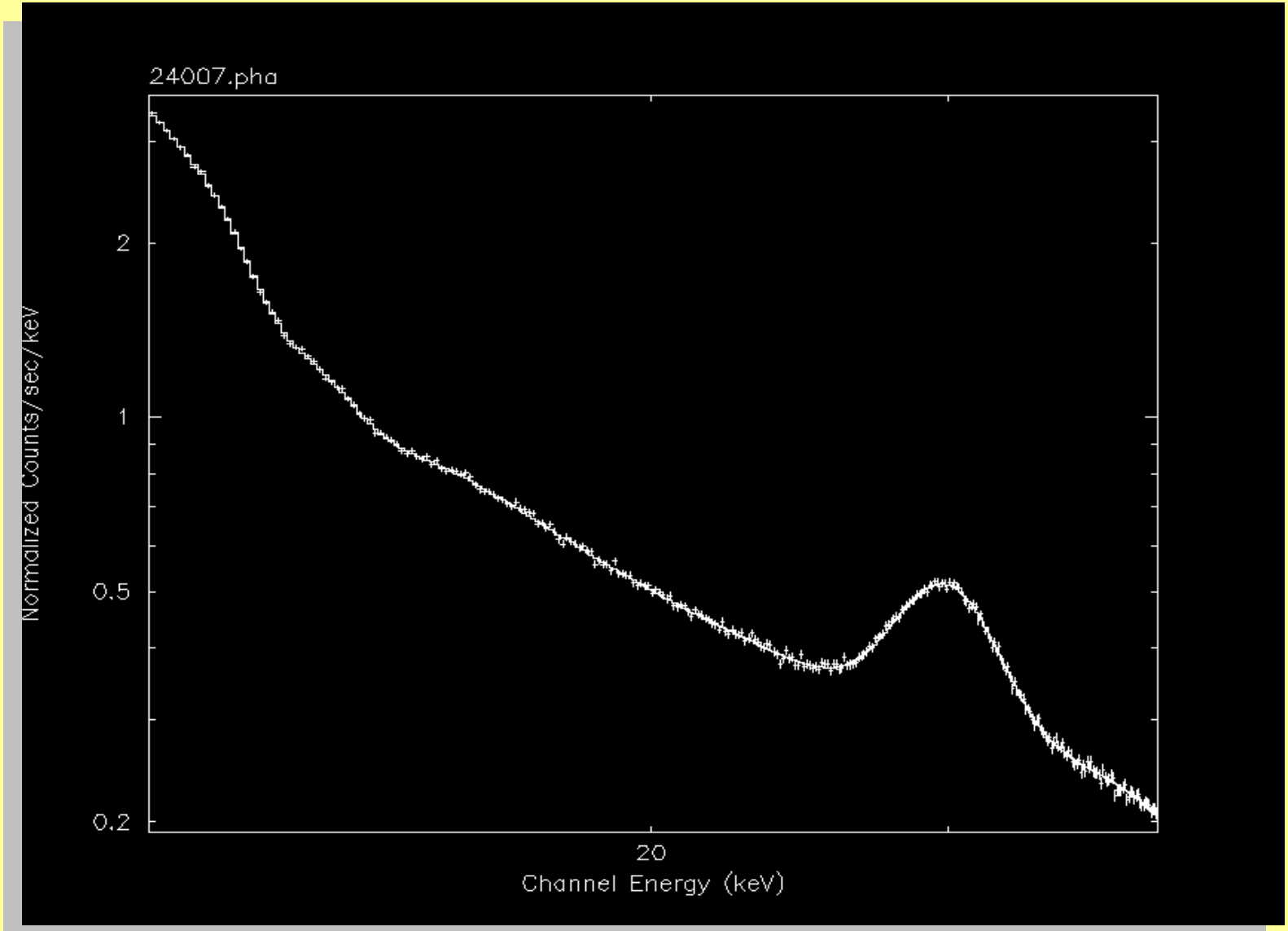
No Background: need properly normalized background

2004 web background gives ***huge*** background

Assumptions:
2-10 keV flux=
8e-15 ergs/s/cm2
Gamma=1.3
Cut-off E=20 keV (observed)
or 100 keV rest



WEBspec background for Con-X HXT and this observation



Summary

1. **Radio-quiet quasar SEDs in HXT crucial for understanding accretion process, and ultimately the evolution of quasars with redshift**
   - **Galactic binary BHs have cut-off at much higher E**
   - **UV shape not sensitive to parameters of interest**
   - **Only redshifted SMBHs have observable cutoffs**
   - **Sources too faint to make any progress with Astro-E: swamped by background**

2. **Crucial to get background files for HXT that are documented, and realistic.**
   - **Currently files posted on web are confusing**
     - **Hard spectra for z=4 doable if background=0**
     - **With nominal background, no quasar at any redshift will be detectable**